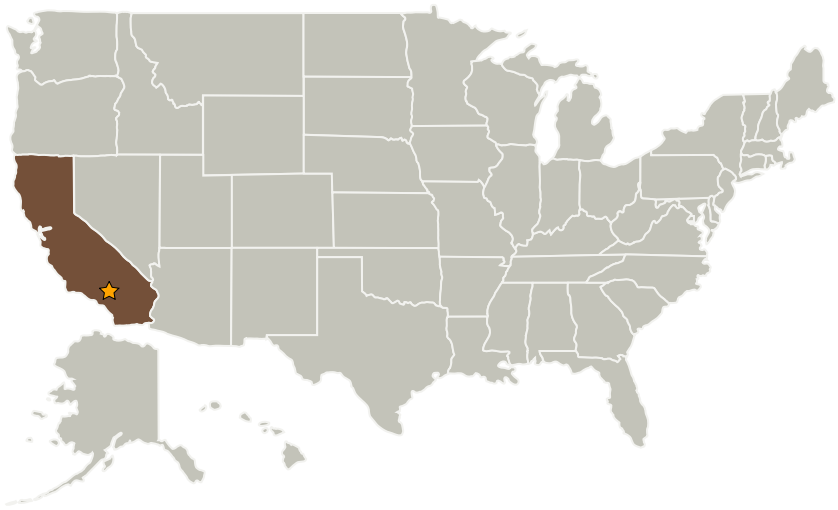
Ceramic Composite Mechanical Fastener System for High-Temperature Structural Assemblies, Phase I

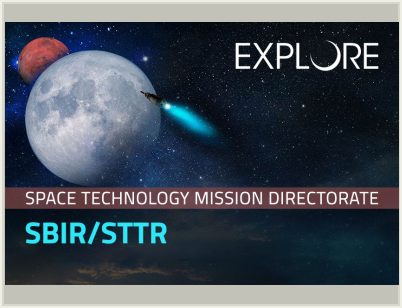
Completed Technology Project (2007 - 2007)

Project Introduction

Hot structures fabricated from ceramic composite materials are an attractive design option for components of future high-speed aircraft, re-entry vehicles and propulsion systems to reduce weight and increase performance. One important detail in the design of such structures is that of joining and attachment. Large-area hot structures will likely be fabricated by mechanically joining smaller component sub-assemblies. Conventional metallic fasteners and fastening techniques do not provide structurally tight joints over a wide temperature range. A metallic fastener, which is snug at room temperature, will loosen at elevated temperature due to its relatively high thermal expansion. Excessive preloading at room temperature to maintain a tight joint at elevated temperature may be detrimental to the structural integrity of the joint. Ceramic composite fasteners on the other hand can be designed with near-perfect thermo-elastic compatibility with the adherends, however their prohibitively high cost to produce severely restricts their utility. The objective of this proposed program is to demonstrate the feasibility of a unique, cost-effective thermal stress-free ceramic composite mechanical fastener system suitable for assembly of high-temperature ceramic composite structures. The innovative fastener design facilitates joining load-bearing hot structural assemblies and can be produced at a cost much lower then other competing designs and methods. Ceramic composite fasteners will be produced and experimentally evaluated to determine the shear and tensile properties of the fasteners both individually and of respective lap-joined ceramic composite assemblies.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
Hyper-Therm High-Temperature Composites	Supporting Organization	Industry	Huntington Beach, California

Primary U.S. Work Locations
California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes